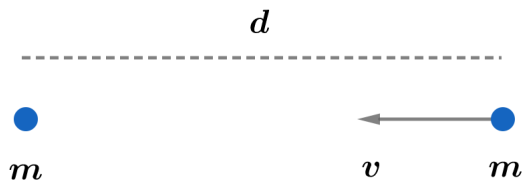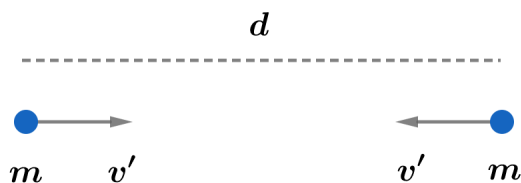# 2019B F=ma Exam: Problem 4

Kevin S. Huang

In the first case, we have from conservation of energy

$$-\frac{Gm^2}{d} = \frac{1}{2}mv^2 - \frac{Gm^2}{r}$$

In the second case, we have from conservation of energy

$$-\frac{Gm^2}{d} = \frac{1}{2}(2m)v'^2 - \frac{Gm^2}{r}$$

so

$$v^2 = 2v'^2$$
$$v' = \frac{v}{\sqrt{2}}$$

The ratio of the relative velocities of the second case to the first case is

$$\frac{2v'}{v} = \sqrt{2}$$

so it will take time $T/\sqrt{2}$ for the two masses to collide (faster than the first case). Thus, the answer is $\boxed{D}$.